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Standing Medical Advisory Committees

REPORT OF THE JOINT SUB-COMMITTEE ON WELFARE FOODS

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CENTRAL AND SCOTTISH HEALTH SERVICES COUNCILS
STANDING MEDICAL ADVISORY COMMITTEES

REPORT OF THE JOINT SUB-COMMITTEE ON WELFARE FOODS

I. Introduction

Appointment of Sub-Committee

1. In March, 1956 the Minister of Health and the Secretary of State for Scotland sought the advice of the English and Scottish Standing Medical Advisory Committees on the need for the welfare food supplements which were introduced during the war and have been provided ever since.

2. The two Committees decided to set up a joint sub-committee with Sir Henry Cohen (later Lord Cohen of Birkenhead) as Chairman, three members from each of the parent committees, and nominees of the Medical Research Council and the professional bodies most concerned.

The terms of reference of the sub-committee were:

> " To advise on the general question of the present need for welfare foods supplements (other than milk) to the diet of expectant and nursing mothers and young children under five and on the amount of such supplements (if any) needed by the average child at various ages; with particular reference to the requirements of children for vitamin D and the need for orange juice of children aged two to five ".

The membership of the sub-committee is shown on page 2.

The sub-committee is deeply indebted to its secretaries, Dr. W. T. C. Berry and Mrs. E. McKenzie, for their unremitting work. Their experience and knowledge of relevant sources of information have greatly helped the work of the sub-committee.

Dr. Dorothy Taylor and Mr. T. W. Williams of the Ministry of Health, Dr. R. J. Peters and Dr. Charlotte Douglas of the Department of Health for Scotland have attended meetings.

Committee's Activities

3. The Committee met on five occasions. At the request of the Minister of Health and the Secretary of State for Scotland, an interim report on orange juice was made in June, 1956. This was incorporated in a report to the Standing Medical Advisory Committees in December, 1956, which also included recommendations on the content of vitamin D in welfare foods. The recommendations made in this interim report did not differ from our present conclusions.

II. Background

Brief History of Welfare Foods Scheme

4. The Welfare Foods Scheme came into being during the war to ensure that expectant and nursing mothers(i) and young children should not suffer from the lack of certain essential nutrients.

(i) The terms " expectant mothers " and " nursing mothers " are used to denote " pregnant women " and " lactating women ".

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5. Fruit juice for children under two and national cod liver oil for children under five were first provided in the autumn of 1941 on the recommendation of the Standing Committee on Medical and Nutritional Problems. In 1943 the increased availability of orange juice under Lend-Lease made it possible to include children up to five and expectant mothers. National cod liver oil was also made available to expectant mothers and later in the year vitamin A and D tablets were introduced as an alternative. These tablets were also supplied to mothers to take during the thirty weeks following confinement.

6. Initially, natural cod liver oil which contained 100 i.u. of vitamin D per g. was provided but in 1942, on the recommendation of the Medical and Professional Sub-Committee of the Minister's Advisory Committee on Mothers and Young Children, the vitamin D content was increased to 200 i.u. by fortification.

7. In 1940, National Dried Milk was produced in order to provide a reliable baby food at a time when the production and distribution of proprietary brands were uncertain. At first it was not fortified but in 1945, on the recommendation of the Medical and Professional Sub-Committee of the Minister's Advisory Committee on Mothers and Young Children, vitamin D was added to provide a minimum of 280 i.u. per dry oz. This followed an investigation into the incidence of rickets by the British Paediatric Association which advised better prophylactic measures because of the low uptake of national cod liver oil.

8. The success of the Welfare Foods Scheme has been generally recognised and much of the improvement in the well-being of children during and after the war has been attributed to it. In 1946 the Government decided to continue it as part of the peace time social services. At that time there were still shortages of many foodstuffs. There have since been great changes in the availability of foods and a widespread rise in the level of incomes. Moreover, the concepts of what is required for good nutrition have somewhat changed and more information is now available about the nutrient contents of diets. These various factors together with the virtual absence of deficiency disease suggested the need to reconsider the case for the continuance of welfare foods on nutritional grounds.

Provision of Welfare Foods (*including distribution*)

9. The Welfare Foods Scheme provides:

(*a*) Vitamin supplements in the form of welfare orange juice, national cod liver oil and vitamin A and D tablets issued either free or at subsidised prices.

(*b*) Cheap liquid milk or National Dried Milk in lieu.

10. Liquid milk is outside the Committee's terms of reference but it needs to be mentioned because the provision of National Dried Milk is linked with it. Children under five years of age and expectant mothers are entitled to 1 pint of liquid milk a day at the welfare price but National Dried Milk at the equivalent price in 20 oz. tins is available as an alternative. This arrangement makes it possible for the mother to obtain liquid milk if she is breast feeding her baby or National Dried Milk if the child cannot be breast fed, or is weaned.

11. Books of tokens are issued by National Insurance Offices to expectant mothers and for children on production of pregnancy or birth certificates. Since July, 1954, when local food offices closed down, welfare foods have been distributed from centres run by local health authorities.

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12. The amounts and vitamin content of the various food supplements to which each category of beneficiary is entitled are set out in detail in Appendix 1. In brief, these are:

Welfare orange juice, providing a daily intake of about 9 mg. of vitamin C for children under six months, 26 mg. for children six months to five years and 30–40 mg. for expectant mothers.

National cod liver oil (for children under five and expectant mothers), providing a daily intake of about 3,500 i.u. of vitamin A and about 800 i.u. of vitamin D (babies start with less).

Vitamin A and D tablets, providing a daily intake of about 4,000 i.u. of vitamin A and about 800 i.u. of vitamin D to mothers for thirty weeks after confinement and to expectant mothers, as an alternative to cod liver oil.

National Dried Milk, providing a minimum daily intake varying from about 550 i.u. to 1,400 i.u. of vitamin D in the amounts consumed by babies of different ages.

13. Since the war there has been a fairly steady decline in the uptake of all welfare foods. Table 1 shows the welfare foods distributed in recent years expressed as a percentage of the amounts which would have been issued if all potential beneficiaries had taken their full entitlement.

TABLE 1

Uptake of Welfare Foods as a Percentage of Entitlement

Year	Orange juice	Cod liver oil	Vitamin tablets
1948	36	34	37
1949	34	31	36
1950	31	27	33
1951	31	27	33
1952	34	28	34
1953	31	24	32
1954	28	21	29
1955	30	19	32

14. There was some concern in 1954–55 lest the fall in consumption might be due to difficulties resulting from changes in the system of distribution. An enquiry into consumption of welfare foods carried out for the Ministry of Health in 1955 showed that there was little evidence that these changes were responsible for the decline. It was found that some two-thirds of those interviewed had obtained some welfare foods during the four months prior to interview, a proportion almost identical with that obtained from a similar enquiry in 1951. The slight upward trend in the consumption of welfare orange juice and vitamin tablets which started in 1955 has continued during the first half of 1956, but there has been a further slight fall in the uptake of national cod liver oil.

III. Work of the Sub-Committee

Evidence Considered

15. At the outset we had before us a background statement which included the information given above and referred to the results of various investigations (some unpublished) into the diets of mothers and young children and their consumption of welfare foods. We approached our task on the general question

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of the present need for supplements, by analysing all available information as to the uptake of welfare foods, by examining data on the nutrients in the diets of mothers and children and by obtaining and considering information from which we might obtain a broad picture of the health of mothers and young children.

16. *Uptake of welfare foods.* Besides the departmental figures already mentioned above, we have had before us the results of two detailed enquiries into the amounts of welfare foods consumed by beneficiaries. The first of these was undertaken in 1951 for the Ministry of Food and the second was carried out on similar lines in October and November, 1955, for the Ministry of Health. More detailed information on infant feeding was obtained for us by one of our members, Dr. Dykes, who carried out a special enquiry at Luton (Appendix 3), and by Dr. R. C. Wofinden, Medical Officer of Health of Bristol who, at our request, investigated feeding in his area (Appendix 4).

17. *Nutrients in the diets of mothers and young children.* We are indebted to Dr. Angus Thomson of the Obstetric Medicine Research Unit, University of Aberdeen, for data on the vitamin A and C intakes of pregnant women in Aberdeen(i). Information about the diets of children between the ages of six months and five years was derived from a survey made for the Ministry of Health in 1951, some findings of which have been published by Bransby and Fothergill(ii). We have also considered data of a more general character obtained from the National Food Survey of the Ministry of Agriculture, Fisheries and Food(iii).

18. *On the health of mothers and children.* In order to obtain a general picture of the occurrence of deficiency disease, letters were sent by the Ministry of Health to a number of obstetricians, paediatricians and Medical Officers of Health, asking how many cases of rickets, scurvy and avitaminosis A they had encountered in the last two years among young children and in expectant and nursing mothers. Similar enquiries were made by the Department of Health for Scotland and the Welsh Board of Health. We do not know the population involved, but it certainly includes some millions in England, all Wales and much of Scotland, because many of those who replied had consulted their colleagues, and some of them were in charge of hospitals to which unusual cases are referred from a wide area.

19. In relation to hypervitaminosis we considered the report of the British Paediatric Association's Committee on Hypercalcaemia(iv) and a report made by the Medical Research Council Conference on Hypercalcaemia in Infants in 1956(v).

20. We wish to express our indebtedness to all those who have provided information.

21. The essential features of this evidence are set out and discussed in the following sections which deal separately with vitamin C, vitamin A, vitamin D for children, vitamin D for expectant and nursing mothers and possible results, other than deficiency disease, of failure to consume welfare foods. In Part IV, we set out separately our general conclusions and those relating to each of the welfare foods supplements.

(i) Not published.
(ii) Bransby (E. R.) and Fothergill (J. E.) 1954. British J. Nutrition, **8**, p. 195.
(iii) National Food Survey Committee, Annual Reports. H.M.S.O.
(iv) British Medical Journal, July, 1956, p. 149.
(v) Not published.

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Uptake and Consumption of Welfare Orange Juice

22. Recent information on the uptake and consumption of welfare orange juice was obtained from the enquiry carried out for the Ministry of Health in October and November, 1955 (loc. cit.). The findings differed little from those of the 1951 enquiry.

23. In the week prior to interview between 43 per cent. and 51 per cent. of children under five and about 40 per cent. of expectant mothers took no orange juice. For children, this was less than in 1951. Table 2 below shows that the proportions taking orange juice fell with increasing age. Older children who did take it consumed larger quantities, but they are, of course, entitled to three teaspoonfuls instead of one, from the age of six months.

TABLE 2

Weekly Consumption of Welfare Orange Juice

	Year of birth	Number in group	Percentage taking orange juice			Vitamin C daily average per person taking (mg.)
			0 days	1–6 days	7 days	
Children	1955	463	43	27	30	8·7
	1954	551	46	25	29	15·2
	1953	546	49	21	30	18·0
	1952	524	51	20	29	18·8
	1951	556	51	22	27	17·2
Expectant mothers...		185	41	25	34	22·8

24. Of all the families interviewed, 32 per cent. had taken no welfare orange juice in the four months prior to interview. The proportion taking orange juice was highest for families consisting solely of an expectant mother and for those with a child under six months.

25. The consumption of welfare orange juice was found to rise with income and occupational status and with the age of the mother on leaving school, as shown in Table 3 below.

TABLE 3

Consumption of Welfare Orange Juice according to Social-economic Groups

Percentage taking Orange Juice during Week

Father's income		Father's occupation		Mother's age on leaving school	
Up to £7 10s. 0d.	50%	Unskilled ...	46%	Up to 14 ...	50%
£7 10s. 0d. to £10	52%	Skilled operatives ...	51%		
£10 or more ...	56%	Clerical and inspectional ...	55%	15 and 16 ...	54%
		Managerial and professional ...	64%	17 and over ...	63%

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26. A similar trend in the uptake of expectant mothers was found in an independent study carried out by Marr *et al.* in Aberdeen in 1955(i), which related uptake to the Registrar-General's social classes(ii).

TABLE 4

Uptake of Welfare Orange Juice by Expectant Mothers of Different Social Classes in Aberdeen (i)

Number of cases	76	187	461
Husband's social class	I and II	III	IV and V
Consumption	per cent.	per cent.	per cent.
Regular, 5 or more days/week ...	53	42	31
Irregular	12	18	20
None	36	40	49

27. The enquiry carried out for the Ministry of Health in 1955 revealed that more families were using proprietary preparations than in 1951. In 1955, 44 per cent. of all families not taking welfare orange juice had bought some proprietary preparation containing ascorbic acid in the previous four months. Even so, some 18 per cent. of all families were " unprotected " (i.e. taking neither orange juice during the week before interview nor a proprietary preparation in the previous four months), the proportion being higher in the families with older children.

Vitamin C in the Diet of Children

28. The diets of children aged six months to five years were surveyed in 1951 (loc. cit.) and the average intakes of vitamin C are given below.

TABLE 5

Intakes of Ascorbic Acid by Children aged 6 months to 5 years

Age	Number of children	Average daily intake (mg.)	Standard error of daily intake (mg.)	Range of daily intakes		Quartile*	
				Minimum (mg.)	Maximum (mg.)	Lower (mg.)	Upper (mg.)
6–12 months ...	75	14·2	0·96	4	43	7	15
1 - year ...	97	20·8	1·25	3	53	10	28
2 - ,, ...	105	24·3	1·60	5	96	11	30
3 - ,, ...	106	26·4	1·44	4	72	14	33
4 - ,, ...	78	28·2	1·99	5	98	17	35

* The value above or below which 25 per cent. of the cases occur.

(i) Marr (J. W.), Hope (E. B.), Stevenson (J. D.) and Thompson (A. M.) 1955. Proc. Nutrit. Soc., 14, p. 7.

(ii) Registrar-General's social class scale: I. Professional, managerial, etc;
II. Intermediate (farmer, shopkeeper, teacher, executive, civil servant, etc.);
III. Skilled workers (coal face worker, most clerks);
IV. Partly skilled workers (machine minder, some miners, most agricultural workers);
V. Unskilled workers (railway porters, labourers, navvies).

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29. The lower quartile occurs at or below the level of vitamin C intake (10 mg. helow the age of two and 15 mg. ahove) recommended by the B.M.A. Committee on Nutrition, 1950(i) (see Appendix 2). That is to say, ahout 25 per cent. of children were on diets which are by this criterion "low". The sources of vitamin C in the diets of such children are of interest. During the first year of life about 80 per cent. comes from milk of one form or another. After the age of one potatoes and other vegetahles together provide nearly twice as much vitamin C as does milk. Though the dietary figures relate to 1951, the position is unlikely to be much changed. A characteristic of these "low" diets was that the contrihution from citrus fruit was invariably small. We learn from the records of food passing into civilian consumption, and from the National Food Survey data(ii), that there has been a fall in consumption of oranges in recent years.

30. As might be expected, many of these children did not receive welfare orange juice or a proprietary preparation. The effect of such supplements was, broadly, to reduce, by a little less than half, the numher whose intakes were below the levels put forward by the B.M.A.

Vitamin C in the Diet of Expectant Mothers

31. Dr. Angus Thomson's evidence on the average intakes of primigravidae in Aherdeen (loc. cit.) showed a social trend of diminishing intakes, from 91 mg. daily in the Registrar-General's social class I & II (RGI & II) to 71 mg. in RGV. This refers to food as purchased and, when allowance was made for cooking losses, 17 per cent. of women in RGI & II and 46 per cent. in RGV were judged to he on intakes helow the recommended B.M.A. level of 40 mg.

Occurrence of Disease due to Vitamin C Deficiency

32. Howell *et al.* (1954) (iii) reported six cases of scurvy in children in Cornwall, in the years 1950–52, and stated that ten cases had heen seen in the previous five years at Great Ormond Street Hospital. Birmingham Children's Hospital (Braid, 1954)(iv) had seen one or two cases annually, hut saw seven in 1954.

33. In the replies received from the nine paediatricians consulted in England, eighteen cases of scurvy were reported, nearly all towards the end of the first year, and a further six cases were reported from Wales. One case was also reported in a child aged seven with mental retardation and persistent vomiting due to a chronic suhdural haematoma, and one case, over the age of two, with no special features, was reported hy one of our memhers. Paediatricians in Scotland reported two cases in 1953 and none since.

34. The nine obstetricians and seven Medical Officers of Health in England who replied to the Ministry's enquiry, were unanimous on the absence of scurvy in expectant mothers. The replies received from Scotland and Wales were also uniformly negative.

(i) British Medical Association. Nutrition Committee. Report, 1950, London.

(ii) National Food Survey Committee, Annual Reports, H.M.S.O.

(iii) Howell (G.), Palmer (P. E. S.) and St. John-Brooke (W. H.) 1954. Brit. Med. J., 2, p. 1143.

(iv) Braid (F.) 1954. Brit. Med. J., 2, p. 1232.

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Discussion

35. Clearly, scurvy does occur sporadically in children throughout Great Britain. The fact that most cases occur about the end of the first year may be explained by the finding of the 1951 survey that up to the age of one, in children on "low" intakes, the sole important dietary source of vitamin C is milk, a food subject to destructive processing, particularly in the home. In older children some protection is provided by the greater variety of the diet, and scurvy is virtually non-existent, even though, as evidence has shown, many do not take welfare orange juice, other vitamin preparations, or appreciable amounts of citrus fruit.

36. The reported absence of scurvy in expectant mothers is to be expected from the evideuce on intake levels supplied by Dr. Thomson. Though many of the intakes are below the B.M.A's recommended levels, a considerable margin exists between such levels and that at which scurvy develops.

Vitamin A

General Consideration

37. We took note of the view expressed in the Medical Research Council's Report on Human Milk (Kon and Mawson, 1950)(i) that "the mechanism for secreting vitamin A into milk is such that unless the mother's vitamin A reserves are low or exhausted . . . the infant is unlikely to suffer a shortage". The milk of mothers studied by them during the war supplied on average 1,100 i.u. of preformed vitamin A to babies at the age of six months. The intake by bottle-fed babies probably varies seasonally but is on average little below that of breast-fed babies.

38. The average intake, from all sources, of vitamin A by the children studied by Bransby and Fothergill (loc. cit.) was about 2,300 i.u. daily.

39. Dr. Thomson reported a social trend in the average supply of vitamin A from the diets of Aberdeen primigravidae (loc. cit.) from 7,000 i.u. daily in RGI & II to 5,500 in RGV.

40. The obstetricians and paediatricians reported an absence of any disease which could be ascribed to hypovitaminosis A in the groups under their care, as is to be expected from what has been said above.

41. Government policy has been that where vitamin A can be conveniently provided in the supplements used to supply vitamin D, this should be done, but that there is no need for any special provision beyond this.

Vitamin D for Children

Uptake and Consumption of National Cod Liver Oil

42. The decline in consumption of national cod liver oil has been greater than that of other welfare foods. The enquiry of October, 1955, showed that more than half the children born in that year took no national cod liver oil in the week prior to interview. Among older children the proportion was even higher. The proportions taking it daily declined from about 36 per cent. of those born in 1955 to about 20 per cent. of older children.

(i) Kon (S. K.) and Mawson (E. H.) 1950. Med. Res. Counc. Spec. Rep. Series, No. 289.

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TABLE 6

Weekly Consumption of National Cod Liver Oil

Child's year of birth	Number in group	Percentage taking cod liver oil			Vitamin D daily average per person taking i.u.
		0 days	1–6 days	7 days	
1955	463	54	10	36	600
1954	551	60	14	26	750
1953	546	67	12	21	820
1952	524	69	12	19	800
1951	556	68	11	21	830

The last column of the Table suggests that many of the children over one year of age taking cod liver oil, took more than the standard dose of one teaspoon a day (800 i.u.).

43. Less than half of all the families interviewed had taken some cod liver oil in the previous four months but the proportion was higher (66 per cent.) in families which included a child under six months.

44. As with welfare orange juice, families in the higher social groups took more national cod liver oil as shown in Table 7.

TABLE 7

Social Status and Consumption of National Cod Liver Oil

Percentage taking National Cod Liver Oil during Week

Father's income		Father's occupation		Mother's age on leaving school	
Up to £7 10s. 0d.	... 34%	Unskilled ...	... 32%	Up to 14 ...	... 35%
£7 10s. 0d. to £10	... 35%	Skilled operatives ...	35%		
£10 or more ...	... 39%	Clerical and inspectional ...	... 38%	15 and 16 ...	... 36%
		Managerial and professional ...	... 41%	17 and over ...	... 43%

45. About 42 per cent. of families with children which took no cod liver oil (i.e. some 27 per cent. of the total) purchased some alternative preparation. Even so, the percentage of children taking neither ranged from 20 per cent. of those born in 1955 to 37 per cent. of those in their fifth year.

Vitamin D in the Diet of Children under Two

46. In infancy the contribution from breast or cow's milk is of the order of only 5–20 i.u. daily, so that apart from sunlight, the major sources of vitamin D for the infant are vitamin preparations and foods which have been fortified with vitamin D. These are dried milks and infant cereals (a term which will be used below to cover also certain infant rusks).

47. The vitamin D content of national cod liver oil compound, National Dried Milk, or infant cereal, as stated on the label, is such that any one of them protects from rickets if the product is regularly consumed in ordinary amounts.

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But difficulties bave been experienced in assaying vitamin D in certain foods with accuracy; this is a problem which the Committee considers needs further investigation. Vitamin D is also liable to deteriorate during sbelf life. A considerable margin is often added, therefore, to ensure that the stated amount is present. As a result, unnecessarily high intakes can result when more than one source of vitamin D is taken, with, in the view of the British Paediatric Association's Committee on Hypercalcaemia (loc. cit.), possible risks.

48. Evidence on the parts played by dried milk, cereals, and vitamin D preparations in infants' diets, was obtained for us through enquiries undertaken in Luton by Dr. Dykes, and in Bristol by Dr. R. C. Wofinden. (Appendices 3 and 4). The Luton enquiry related to all babies aged 1–11 months and the Bristol study to a random sample of babies aged 6–11 montbs. There are some small differences between the two sets of findings and presumably further differences could be found in other parts of the country, but it is probable that the inferences drawn below from the studies apply in greater or less degree throughout the country.

49. All but a few children in the age groups 6–11 montbs (0–7 per cent. in both places) received vitamin D from one source or another. This applies also to breast-fed babies in Luton, although data regarding tbem is not given in Appendix 3. In the early montbs either dried milk and/or cod liver oil were largely responsible for the vitamin D intake, but from the fourth month cereal consumption became increasingly common. A second point of particular interest is that 85 per cent. of children in the second six months of life took some cereal and, in Luton, the proportion whose sole dietary source of vitamin D was cereal during the 9th to 11tb montb, ranged from 20 per cent. to 32 per cent.; in Bristol the range was 10 per cent. to 20 per cent.

50. The amount of cereal eaten varied with the child. In Bristol it was found that 42 per cent. ate less than ½ oz. daily, 50 per cent. ate ½–1½ oz. and 8 per cent. more than 1½ oz.

51. In botb areas, approximately 30 per cent. of children were receiving vitamin D from all three sources (cereal, dried milk, and also cod liver oil) at the age of 6 months, after whicb the percentage declined.

52. Tbere is a fair measure of agreement between these two studies and tlie results of the survey carried out in 1955. For example, the percentage of babies aged 6–12 months taking some national cod liver oil was found to be 40–46 per cent. by the 1955 survey, 46 per cent. in Luton and 54 per cent. in Bristol. On the other hand, the 1955 enquiry found that the uptake of national cod liver oil by children under five was about 35 per cent., whereas the estimate based on entitlement for that year was only 19 per cent. as sbown in Table 1. In studying tbe evidence we had in mind the possibility that some mothers might have given false replies to enquiries about cod liver oil or vitamin preparations because they felt their children ougbt to bave taken them, but there seems no reason why they sbould do so in regard to infant cereals or dried milk.

Occurrence of Rickets in Children under the age of Two

53. Only thirteen cases of rickets under the age of two were reported in England by the paediatricians tbougb nearly all of them reported at least one case. In Wales only nine cases of rickets were reported and in Scotland it is also rare.

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One paediatrician remarked, however, " With regard to rickets it would be unwise to assume the absence of borderline cases with minimal physical signs, and in these radiological or biological confirmation might not be attempted ".

Discussion

54. Whilst tbe precise relationship between hypercalcaemia and vitamin D intakes has not at the time of writing been established, we are in agreement with the view of tbe British Paediatric Association Committee on Hypercalcaemia (loc. cit.) that unnecessarily high intakes carrying possible risks can result from present fortification practices.

55. On the other hand, as the reports of the paediatricians show, some rickets does still occur. As Dr. Dykes' and Dr. Wofinden's enquiries indicate, no one major source of vitamin D is consumed by all infants, although the interplay of the three sources that we have considered is such that most infants are in one or other way " protected ". A few, however, are not, and the reports of the paediatricians, that very occasional cases of rickets do occur, are in accord with this.

56. Because each of the three foods which we have considered is the sole source of vitamin D for part, at least, of the life of some infants, it is likely that its elimination from any one of them would increase the incidence of rickets. Even infant cereals, from which it has been suggested (Report of the B.P.A. Committee on Hypercalcaemia, loc. cit.) calciferol could be removed, is the sole major source of vitamin D for some infants, particularly in the second six months of life, when rickets is most liable to occur.

57. The problem, as we see it, is to reduce the vitamin D content of all tbree major sources in such a way that any one of them will protect from rickets if taken in the usual amount, but all three in combination will be unlikely to lead to harmful intakes of vitamin D, in any individual.

58. Though the diet contains much less vitamin D in the second year of life, there is no concomitant increase in the cases of rickets reported. Conceivably the child stores some of the vitamin D which it receives so abundantly in tbe first year of life, and is thus protected against rickets in later years; or possibly the process of growth is such that less risk is involved after the first year. Sunlight may play a greater part in the second year of life as a source of vitamin D. Less vitamin D is required where the calcium intake is high. In this age group according to Bransby and Fothergill (loc. cit.) the calcium intake averaged 0·75 g. daily. In this connection the investigation by tbe British Paediatric Association in 1943(i) is also of interest. The Welfare Foods Scheme was in existence then but dried milks and cereals were unfortified, yet, out of 1,490 children aged 12–18 montbs, only three had active rickets.

Vitamin D in the Diet of Children aged Two to Five

59. The vitamin D intakes of the cbildren studied by Bransby and Fothergill were not reported but we had access to relevant parts of the raw data and were able to assess roughly the average intake.

(i) British Paediatric Association. Report on Public Health and Medical Subjects, No. 92. H.M.S.O. 1944.

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60. Where margarine was eaten, the vitamin D in the diet was about doubled, but only 40–50 per cent. of children ate it. In round figures those who ate margarine received about 70 i.u. of vitamin D and those who did not 35–40 i.u. The calcium intake was again about 0·75 g.

Occurrence of Rickets over the age of Two

61. The paediatricians reported seven cases of rickets over the age of two, of which three were stated to be mental defectives.

Discussion

62. In this age group there is a substantial proportion of children who receive no form of vitamin D except from their diet, and this provides only a fraction of the recommended intake. Yet rickets in this group is rare. Possibly what has been suggested above in relation to the second year of life also applies in later years.

Vitamin D for Expectant and Nursing Mothers

Uptake and Consumption of Vitamin A and D Tablets or National Cod Liver Oil

63. The decline in the uptake of vitamin tablets has been less than for other welfare foods and during the last eighteen months there has been a slight upward trend in the amounts distributed. The 1955 enquiry found that 35 per cent. of expectant mothers and 75 per cent. of the mothers of new born babies did not take either tablets or cod liver oil in the week prior to interview (Table 8). Women who were expectant for the first time were more inclined to take welfare foods.

TABLE 8

Weekly Consumption of Vitamin A and D Supplement

Group	Number in group	Percentage taking vitamin A and D supplement			Daily average per person taking	
		0 days	1–6 days	7 days	Vitamin A i.u.	Vitamin D i.u.
Expectant mother ...	185	35	14	51	4,700	930
Mother of new-born baby.	292	75	9	16	4,300	850

The figures in the last column indicate that those women who did take their vitamin A and D supplement took more or less the recommended amount.

64. About 26 per cent. of the expectant mothers and 44 per cent. of the mothers of new babies who did not take vitamin tablets during the four months prior to interview had bought a proprietary preparation. Of those expectant for the first time only about 9 per cent. were " unprotected " (i.e. taking neither vitamin A and D supplement nor a proprietary preparation in the previous four months). It is not possible from the information obtained to make an altogether satisfactory estimate of the proportions of mothers with families who were " unprotected ", but 25 per cent. of the families containing the mother of a new baby and 32 per cent. of the families containing an expectant mother with children had not taken vitamin tablets, cod liver oil or a proprietary preparation during the four months prior to interview.

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65. As with orange juice, the proportions taking vitamin A and D tablets fall with the social class. Data on this point from the survey carried out by Marr *et al.* (loc. cit.) in 1955 is shown in Table 9 below.

TABLE 9

Uptake of Vitamin A and D Tablets by Expectant Mothers of Different Social Classes, in Aberdeen, 1955

Number of cases	76	187	461
Husband's social class	I and II	III	IV and V
Consumption	per cent.	per cent.	per cent.
Regular, 5 or more days/week ...	60	52	41
Irregular	12	12	10
None	28	35	49

Vitamin D in the Diet of Expectant and Nursing Mothers and Evidence of Hypovitaminosis D

66. The average calorie content of the diet in the households (of two young adults only) surveyed in 1954 by the National Food Survey(i) was 3,174, with a vitamin D content of 163 i.u. and a calcium content of 1·226 g. The calorie intake recommended by the B.M.A. Committee on Nutrition (loc. cit.) ranges from 2,500 to 3,000 at different stages of pregnancy and lactation. Probably, therefore, expectant and nursing mothers derive from the diet some 140 i.u. of vitamin D and about 1·0 g. of calcium daily. Rough though these estimates must be, it seems that there is a considerable difference between dietary intakes of vitamin D and the recommended levels (400–800 i.u. daily at different stages in pregnancy and lactation). Yet deficiencies of vitamin D were not reported by any obstetrician or any Medical Officer of Health consulted.

Discussion

67. This discrepancy between known intakes and theoretical requirements is presumably due to the latter having been based on low levels of calcium in the diet. But as shown in paragraph 66 above, in Britain the calcium intake is at a satisfactory level.

Possible Results, Other Than Frank Deficiency Disease, Of Failure To Consume Welfare Foods

Stillbirths and Neonatal Deaths

68. The evidence already considered in relation to social class and uptake of welfare foods is to the effect that those whose diets are least likely to be adequate make least use of the service.

69. Because of the possibility that this might be reflected in some less obvious way than as overt deficiency disease, certain statistics are shown below.

70. The Registrar-General's Decennial Supplement(ii) shows a difference in the stillbirth and neonatal death rates of different social classes (Table 10).

(i) Annual Report of the National Food Survey Committee. H.M.S.O. 1956, p. 83.
(ii) Registrar-General's Decennial Supp., 1951, Part I, pp. 26 and 30.

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TABLE 10

Stillbirth and Neonatal Rates in 1950

Social class	Stillbirth rate (per 1,000 total births)	Death rate under 4 weeks (per 1,000 live births)
I	16·7	12·9
II	19·6	16·4
III	22·1	17·9
IV	24·7	20·5
V	26·1	22·5

71. The neonatal mortality is higher in " premature " (underweight) babies, and the incidence of " prematurity " is higher where the environment is poor (Gibson and McKeown, 1951)(i). Such social differences were found by Douglas (1950)(ii) to be significant only in primiparae aged 20 years or less or in multiparae with closely spaced pregnancies. Neither of these studies dealt specifically with nutrition, but Dr. Thomson provided evidence (loc. cit.) to show that the incidence of births of 6 lb. or less is lower where the maternal intake of vitamin A or C is high. Of course, Dr. Thomson left entirely open the question of whether there is any causal relationship.

Growth of Children

72. Similarly, by the age of 5–6 there are small but statistically significant differences in the stature of children of different social classes (Hammond, 1953)(iii). Gore and Palmer (1949)(iv) reported that consistent differences between the children of boroughs with different types of population first appeared about the age of 18 months. These social class differences, which are, in fact, differences in growth rates, persist through school life.

Discussion

73. The uptake of welfare foods and the mortality and growth records are both related to social status, but that is not to say that there is a causal relationship. Other factors, besides nutrition, are related to social class and are known to affect the stillbirth and neonatal rates, and are thought to affect growth. But it is known that degrees of nutritional deficiency short of overt disease may affect growth and reproductive efficiency. Equally they may be manifest in ways that cannot be assessed from statistical records.

74. Our views on the significance of this evidence in relation to our problem are set out in greater detail in the ensuing section.

IV. Discussion and Conclusions

General

75. Much of the evidence available to the Committee has been neither firm nor unequivocal. For example, we have related dietary intakes to the recommended levels of the British Medical Association's Nutrition Committee, but that

(i) Gibson (J. R.) and McKeown (T.) 1951. Brit. J. Soc. Med., 5, p. 259.
(ii) Douglas (J. W. B.) 1950. J.Obs. Gynaec. Brit. Emp., 57, p. 143.
(iii) Hammond (W. H.) 1953. Brit. J. Prev. Soc. Med., 7, p. 231.
(iv) Gore (A. T.) and Palmer (W. T.) 1949. Lancet, I, p. 385.

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Committee itself stressed how slender was the basis of their recommendations, particularly in respect of the groups with which we are concerned, and subsequent work has not greatly modified that position. It must be remembered that the recommended levels of intake are simply approximations and that, not only are there appreciable variations in the needs of different individuals and in the same individual at different times, but the variations between individuals are influenced by the constituents of their diet and by environmental factors, including sunlight. Again, there is doubt as to whether or not there is a relationship which is causal between the uptake of welfare foods in different social classes and the vital statistics and growth records, because many other associated factors could affect these figures. This doubt could only be resolved by controlled feeding tests the difficulties of which are formidable.

76. But the clinical evidence shows that some, though very little, scurvy and rickets do occur and we consider its implications extend beyond the few score of unfortunates who contract these diseases. It appears to us fair to assume that where there is rickets or scurvy the incidence of these would be greater were the appropriate welfare foods not available. Thus far at least we appear to be on firm ground.

77. Beyond this it is necessary to tread with care. It is generally accepted that, for some vitamins at least, there is a marginal degree of hypovitaminosis which becomes manifest only if the individual is subjected to an appropriate stress. For example, in experimental scurvy, wounds that are deliberately inflicted reveal an impairment of the body's healing capacity, and this may be shown at a stage rather earlier than that at which the classical signs of scurvy develop. But nutritionists are divided as to whether there exists a still wider zone of " deficiency " above this margin. A part at least of the discrepancies between the recommended dietary allowances put out by expert bodies in different countries (Appendix 2) arises out of this difference of opinion. The interpretation put on some of the evidence reported above must depend upon the opinion that is held upon this issue.

78. Even greater uncertainty existed when welfare foods supplements were first introduced. The scheme was regarded as a form of insurance and the possibility of over-insurance was accepted. Though knowledge of nutrition has advanced somewhat, and though in the light of experience doubts have arisen as to certain specific aspects of the scheme, we consider that there is justification for the continuance of the scheme for welfare foods supplements in general.

79. In the following sections we examine the need for the continuance of each of these supplements separately.

Needs of Children for Welfare Foods Supplement of Vitamin C

80. The clinical evidence provides strong grounds for concluding that a source of vitamin C should be provided for children up to the age of two and we **recommend that the provision of welfare orange juice should be continued at the present level to this age group.**

81. The clinical evidence for the two to five age group showed that there was virtually no scurvy and we have had, therefore, to take into account the kind of evidence on whose inconclusive nature we have commented above. There are differences of opinion among us on the needs of this age group for a vitamin C supplement.

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82. **The recommendation of the Committee (with two dissentients) is that there is no need to provide welfare orange juice for children over two because scurvy is virtually non-existent after that age,** even though the uptake of welfare orange juice or other supplements is lowest in the income groups whose diets are least likely to be satisfactory. There is no firm evidence from any source to show that in man there exists a wide zone of " subclinical deficiency " of vitamin C, or indeed, any zone at all other than the marginal one which has been mentioned in paragraph 77. On the contrary, where investigations on man have been adequately controlled, no benefit to health, or enhanced resistance to various stresses, has been found on high, as opposed to moderate or low (10 mg. daily) dietary intake of vitamin C, and no differences in growth were reported in two groups of elementary school children, one with and the other without vitamin C supplement. The provision of orange juice for children two to five years old would be an insurance against a contingency which the available evidence suggests does not exist. Moreover, if the argument that stopping supplementary vitamin C in the two to five age group carries a risk of impaired growth is accepted, it is equally applicable over the age of five until growth ceases.

83. Two of our members (Professor Garry and Dr. Harris) dissent from this recommendation. They hold the view that although cases of scurvy after the age of two have not been observed by the paediatricians who were consulted, except in such special circumstances as mental deficiency and coeliac disease, there may be impaired growth and development or other ill-effects associated with low vitamin C intake and, since there is evidence that the intake of vitamin C in one-fifth to one-third of the children aged one to four years is lower than the level of 15 mg. recommended by the British Medical Association Committee on Nutrition, the supplement should be continued up to five years of age. They stress the disastrously high incidence of disorders of malnntrition and cases of stunted development in the past and hold that, after vitamin D, the provision of vitamin C has probably been among the nutritional factors of greatest practical value in this country. They consider the provision of orange juice is valuable as a token of its nutritional importance and hold that any measure towards an improved intake of vitamin C by children aged two to five years is to be supported as it is in the years of rapid growth (as well as during pregnancy and lactation) that the needs for nutrients in general are no doubt greatest. They also point out that the consumption of fresh oranges has declined during recent years and that it is known from National Food Survey data that the average consumption per head falls as the number of children in the household increases and is very much smaller in the lower income groups. The fact mentioned in paragraph 81 above, that the uptake of welfare orange juice is also lower in these groups, is not regarded by them as justifying its discontinuance but rather as an argument for its continuance. They contend that the available evidence indicates that considerably more of a given nutrient, including vitamin C, is needed for full development and for optimal health than for mere protection against gross deficiency disease, and that the existence of intakes below the reputed requirement, as noted above, constitutes an additional argument for continuing the scheme.

Needs of Children for Welfare Foods Supplements of Vitamin D

84. The clinical evidence is in favour of a continuation of a source of vitamin D for children up to the age of five.

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85. In infancy, the question of the sources needs careful consideration. Earlier we said that in our view the problem was to adjust the vitamin D content of the three major sources so that if any one of them were consumed alone it would protect against rickets, yet the sum of all three sources taken in conjunction would not involve a risk of excessive intake.

86. We consider that this object would be most nearly achieved with the following levels of fortification:

National Cod Liver Oil

400 i.u. per teaspoon (100 i.u. per g., average.)
(Formerly 200 i.u. per g., minimum.)

National Dried Milk

90–100 i.u. per oz., of powder, average.
(Formerly 280 i.u. per oz., minimum.)

Infant Cereals

300 i.u. per oz., of dry cereal, average.
(Formerly up to 1,000 i.u. per oz., minimum.)

87. In deciding on these levels we had the benefit of a report by the Medical Research Council Conference on Hypercalcaemia which advised that an intake of 400 i.u. of vitamin D was adequate throughout infancy and sufficient to protect against rickets. This amount will be obtained from a teaspoon of cod liver oil, but where cereal or dried milk is the sole source of vitamin D, less may be received. It is our view, however, that the amounts of vitamin D provided by dried milk or cereals will be adequate since the level of calcium in cow's milk is four times that of human milk and cereals contain added calcium. This view is endorsed by those of our members who took part in the Medical Research Council Conference. It will be appreciated that the upper limit for the fortification of dried milk is set by the need to avoid excessive dosage at the sixth and subsequent months when many children are taking some cod liver oil and often cereal as well.

88. Appendix 5 shows what the intake of vitamin D by infants on various regimes would be with the level of fortification recommended above. It will be seen from it that the full teaspoon dose of national cod liver oil is not recommended where dried milk is consumed, but we consider it desirable for 7–8 drops to be given in order that the child may become accustomed to cod liver oil from one month, instead of encountering it for the first time at the age of weaning.

89. Infant cereals are outside our strict terms of reference, but we have had to consider them in relation to the level of fortification in National Dried Milk and national cod liver oil. The British Paediatric Association's Committee on Hypercalcaemia reported in 1956 that one way of reducing the vitamin D content of the infant's diet would be to stop the fortification of cereals with calciferol, but the evidence cited above has led us to recommend that fortification should be continued, though at a lower level.

90. We have given our advice on fortification in terms of average values, not minima, because, as shown by the British Paediatric Association, excessive intakes are due, in part at least, to the fact that the manufacturer adds an excess in order to be sure that his product does not contain less than the stated minima. It is for the Government Departments concerned to ensure that in the future the range of variation in vitamin content should be as narrow as possible.

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91. The manufacturers of infant cereals have already declared their willingness to co-operate in achieving desirable levels in infant cereals and we believe that the manufacturers of other dried milks will agree to align their products with National Dried Milk. We wish to point out that if other additional foods consumed by young children were to be fortified with vitamin D this would affect the balance we have tried to strike. We would draw the attention of the Standing Committee on Medical and Nutritional Problems, which has in the past considered the fortification of foods, to this point.

92. **We recommend that children aged one to five years should be given about 400 i.u. a day of vitamin D and that this should be provided in the form of cod liver oil or a vitamin D preparation.**

93. In considering vitamin D intakes of children we have been impressed by the risk of over-dosage arising from the widespread use of proprietary vitamin preparations. For instance, among 460 children studied by Bransby and Fothergill there were seven children who were reported to be receiving on the average 35,000 i.u. vitamin D each daily, derived mainly from such preparations, and it is our impression that excessive intakes are not rare. It seems that some mothers look upon these preparations as a food or ' tonic ' and do not realise that as far as vitamin D is concerned a child can have too much. The question whether proprietary preparations of vitamin D and of foods to which vitamin D has been added should be regulated in any way is outside our terms of reference but we wish to draw the attention of the Standing Medical Advisory Committees to these potential dangers and to the absence of any statutory control of the sale of such preparations.

94. In addition, we consider it important that as far as possible mothers should receive in this matter individual guidance, and that the various agencies to whom they look for professional advice, namely, doctors, maternity and child welfare clinics and health visitors, should be fully aware of the amount of vitamin D contained in the many sources which may be used. We would, therefore, suggest that advice based on our recommendations should be made known widely to those concerned with the welfare of infants. We feel also that there still is, amongst the public generally, a lack of knowledge on the needs of mothers and young children for various nutrients and the sources from which they can be obtained; but it is known that educational measures in this field have been undertaken. These should be continued and extended.

Needs of Expectant and Nursing Mothers for Welfare Foods Supplements

95. No clinical evidence was obtained which would warrant the continuation of the welfare foods service for expectant and nursing mothers, but the Registrar-General's statistics quoted above point to the need to maintain their health at the highest level, and we feel that the possibility that welfare foods play an important part in this must outweigh any objections on grounds of over-insurance.

96. **We recommend therefore, that the provision of welfare orange juice should be continued on the present basis for expectant and nursing mothers.**

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97. We are also agreed that the provision of vitamin D supplement should be continued for expectant mothers and for mothers of new babies during the thirty weeks following confinement. **We recommend that this provision should continue to be made in the form of the present vitamin A and D tablets** which provide 800 i.u. of vitamin D daily and that expectant and nursing mothers who take cod liver oil as an alternative should be advised to take 1½ teaspoons during the latter half of pregnancy and 2 teaspoons during lactation.

Provision of Vitamin A

98. We see no reason to depart from the present policy of providing vitamin A in welfare foods where this can conveniently be done.

Distribution of Welfare Foods

99. Consideration of the machinery for making welfare foods available to beneficiaries does not come within our terms of reference. We feel, however, that in view of the low uptake of these foods it is important that the possibility of improving the present distribution arrangements should be kept constantly under review both by the Government Departments and the local authorities concerned.

V. Summary of Conclusions and Recommendations

Vitamin C for Children

100. We **recommend** that welfare orange juice should continue to be supplied to children under the age of two as at present. Cases of scurvy, although rare, do still occur usually around the age of one or at the beginning of the second year (paragraph 80).

101. We **recommend** that welfare orange juice should be discontinued for children after the second birthday. Scurvy is virtually non-existent above that age owing, no doubt, to the fact that sufficient vitamin C is derived from the more varied diet. There is no firm evidence to show that a wide margin of vitamin C is required beyond that which is fully adequate to prevent scurvy (paragraphs 81–82). Two of our members dissent from this recommendation and consider that the continuance of the present provision of welfare orange juice to children over the age of two is justified. (For statement of their views, see paragraph 83).

Vitamin D for Children

102. We **recommend** that national cod liver oil should continue to be provided up to the age of five years because rickets does occasionally occur in this age group. The level of vitamin D should be reduced to 400 i.u. per teaspoonful (paragraphs 84, 86 and 92). When the infant is being fed on National Dried Milk a full teaspoon dose of cod liver oil should not be given but only 7–8 drops (paragraph 88 and Appendix 5).

103. We **recommend** that vitamin D should continue to be supplied in National Dried Milk but that the level of fortification should be reduced to 90–100 i.u. per oz. of dry powder (paragraph 86).

104. We consider it desirable that the level of vitamin D in infant cereals should be reduced to an average of 300 i.u. per oz. (paragraphs 86 and 89).

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105. Our aim in recommending the above levels of fortification has been to adjust the vitamin D content of these sources so that if national cod liver oil is not consumed, protection from rickets will still be obtained by the vitamin D present in either National Dried Milk and/or infant cereal. At the same time, the levels of fortification which we have recommended are such that even if cod liver oil, National Dried Milk and cereal are all taken, excessive intake of vitamin D is not likely to occur (paragraphs 85–87, 90–91 and Appendix 5). It is desirable, however, that those to whom mothers look for professional advice should be fully aware of the vitamin D content of these various sources (paragraph 94).

106. Attention is drawn to the risk of overdosage of vitamin D arising from the widespread use of proprietary vitamin preparations and the absence of any statutory control of the sale of these products (paragraph 93).

Vitamins for Expectant and Nursing Mothers

107. We **recommend** that welfare orange juice and vitamin A and D tablets should continue to be supplied to expectant and nursing mothers as at present, although there is no firm clinical evidence of hypovitaminosis among them. We consider that the need to maintain the health of expectant and nursing mothers at the highest level justifies this provision (paragraphs 95–97).

Vitamin A

108. Where vitamin A can be conveniently provided in the supplements used to supply vitamin D, this should be done (paragraph 98).

Distribution

109. In view of the low uptake of welfare foods supplements the possibility of improving the present distribution arrangements should be kept under review (paragraph 99).

March, 1957.

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APPENDIX 1

Amounts and Kinds of Welfare Foods (other than liquid milk) and Scale of Entitlement

	Welfare food and beneficiary	Entitlement	Present vitamin content	Daily vitamin intake when consumed at prescribed level (approx.)
1	*Orange Juice*		*per fluid oz.*	
	Expectant mother ...	One 6 oz. bottle every 9 days (at 5d.)		Vit. C. 30–40 mg. (1 tablespoon)
	Child under 6 months	One 6 oz. bottle every 4 weeks (at 5d.)	Vit. C. 60 mg. ascorbic acid	Vit. C. 9 mg. (1 teaspoon)
	Child 6 months — 5 years	One 6 oz. bottle every 2 weeks (at 5d.)		Vit. C. 26 mg. (3 teaspoons)
2	*Cod Liver Oil*		*per fluid oz.*	
	Expectant mother (i) ...	One 6 oz. bottle every 6 weeks (free)	Vit. A. 26,000 i.u. (min.) Vit. D. 5,200 i.u. (min.)	Vit. A. 3,500 i.u. (1 teaspoon) Vit. D. 800 i.u. (1 teaspoon)
	Child 0–5 years ...	One 6 oz. bottle every 6 weeks (free)		
3	*Vitamin A and D Tablets*		*per tablet* (ii)	
	Expectant mother (i) ...	One packet of 45 tablets every 6 weeks (free)	Vit. A. 4,000 i.u. Vit. D. 800 i.u.	Vit. A. 4,000 i.u. (one tablet) Vit. D. 800 i.u. (one tablet)
	Mother of newly-born child	5 packets of 45 tablets (free)		
4	*National Dried Milk* (in lieu of liquid milk)	*at the Welfare price*	*per oz. of dried milk*	
	Child up to 1 year ...	Up to 83 20-oz. tins during first year (iii)	Vit. D. Not less than 280 i.u.	Vit. D. Min. 550 i.u. to 1,400 i.u. according to prescribed feed
	Child 1–5 years ...	One 20 oz. tin per week		Minimum of 800 i.u.
	Expectant mother	One 20 oz. tin per week		Minimum of 800 i.u.

(i) An expectant mother may be supplied with either cod liver oil or vitamin A and D tablets.

(ii) Vitamin A and D tablets also contain 250 mg. calcium phosphate and 0·13 mg. potassium iodide per tablet.

(iii) The entitlement varies according to the age at the date of application.

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APPENDIX 2

Dietary Allowances Recommended for Great Britain, U.S.A. and Canada

The British, U.S.A. and Canadian recommended daily allowances, for vitamins A, C and D in the relevant groups, are given in the table below. They vary, partly because they were formulated with different ends in mind. Thus the British recommendations are " believed to be sufficient to establish and maintain a good nutritional state in representative individuals of the groups concerned. It is recognised that in every group there must be cases where the need for one or other nutrient is greater than that of the average ". The American aim was " the maintenance of good nutrition in healthy persons " in the U.S.A. and the levels are " selected to cover individual variations in a substantial majority of the population " and " provide for increased needs in times of stress and to permit other potential benefits ". The Canadian standards represent " a nutritional floor beneath which maintenance of the health of the people cannot be assured ".

Recommended Dietary Allowances of Vitamins A, C and D for Expectant and Nursing Mothers and Children, for Three Countries

Vitamins	A (i.u.)			C (mg.)			D (i.u.)		
	B.M.A. (mixed diet) (1)	U.S.A. (N.R.C.) (80 per cent. from carotene) (2)	Canada (as carotene) (3)	B.M.A. (1)	U.S.A. (N.R.C.) (2)	Canada (3)	B.M.A. (1)	U.S.A. (N.R.C.) (2)	Canada (3)
Pregnancy									
1st half ...	6,000	5,000	4,000	40	70	—(i)	400	400	400(ii)
2nd half...	6,000	6,000(iii)	6,000	40	100(iii)	—(i)	600	400	400(ii)
Lactating women	8,000	8,000	6,000	50	150	—(i)	800	400	400(ii)
Children 0–1	3,000	1,500	700	10	30	30	800	400	4–800
Children 1–2	3,000	2.000	700–1,000	10	35	30	800	400	4–800
Children 2–5	3,000	2,000–2,500	1,000	15	35–50	30	400	400	400

Sources

(1) British Medical Association. Nutrition Committee. Report, 1950, London.
(2) National Research Council, 1953. Publ. 302. " Recommended Dietary Allowances ". Washington.
(3) Bull. of Canadian Council of Nutrition, 1950. Vol. 2, No. 1. Ottawa.

Notes

(i) Probably 30 mg. but the text does not make it clear whether the ordinary adult allowance applies or whether the requirement is unknown.
(ii) "At least 400 ".
(iii) Third trimester.

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Enquiry into Infant Feeding at Luton

Report by Dr. R. M. Dykes, Medical Officer of Health

1. At Luton an enquiry was made into the method of infant feeding of all children born between 3rd August 1955 and the 16th June 1956. The enquiry was undertaken by health visitors who were asked to complete an enquiry card. The parents were interviewed between the 25th June and the 10th July 1956, i.e., over a period of about 2 weeks. The completed cards were divided into calendar month age groups according to each child's age at the time of interview. The number of children who were available to the enquiry and in respect of whom cards were prepared was 1,401. The number of children for whom cards were completed was 1,313, representing 94 per cent. of the total.

Children by Month of Age at the time of the Enquiry

Month of age ...	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10	–11	0–11
No. of children ...	82	143	141	146	139	135	107	103	104	112	101	1,313

2. The number of children in each month age group is shown above. The smallest age group is at under 1 month of age. Since children born after the 16th June were not included and interviews did not begin until 25th June, babies under 10 days of age were thus precluded from the enquiry.

Breast and Bottle Feeding

3. Fig. 1 shows that the incidence of breast feeding falls very rapidly from 70 per cent. in the first month to about 15 per cent. in the 6th month. In the first month of life 30 per cent. of babies are fed on dried milk and the incidence rises to a peak of 65 per cent. in the 6th month. At the 6th month cow's milk feeding begins to take over and by the 9th month almost 70 per cent. of the babies are fed on cow's milk.

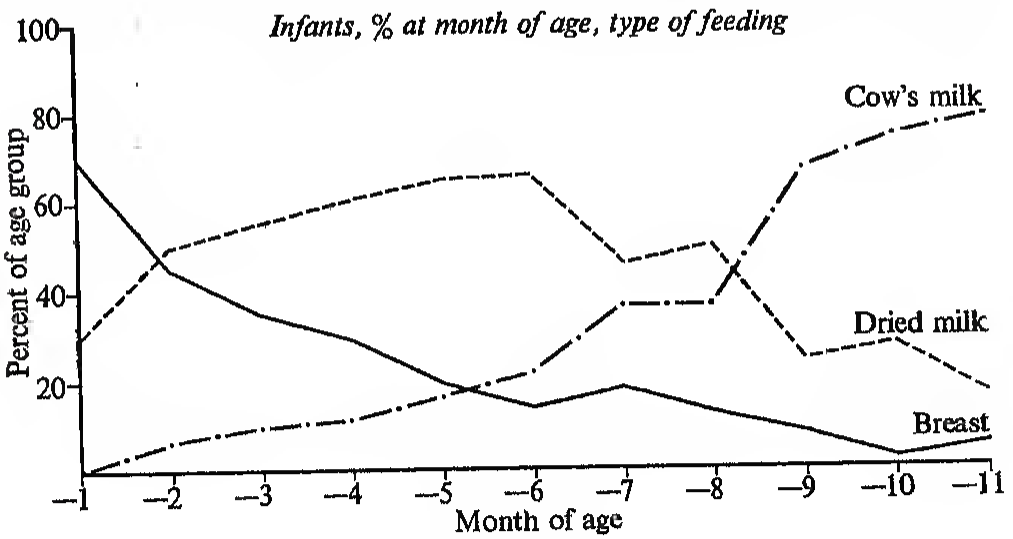

FIGURE 1

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Vitamin C Supplement

4. The percentage of infants at each month of age receiving fruit juice is shown in Fig. 2. From the 3rd to 11th month between 80 per cent. and 95 per cent. are receiving vitamin C supplement.

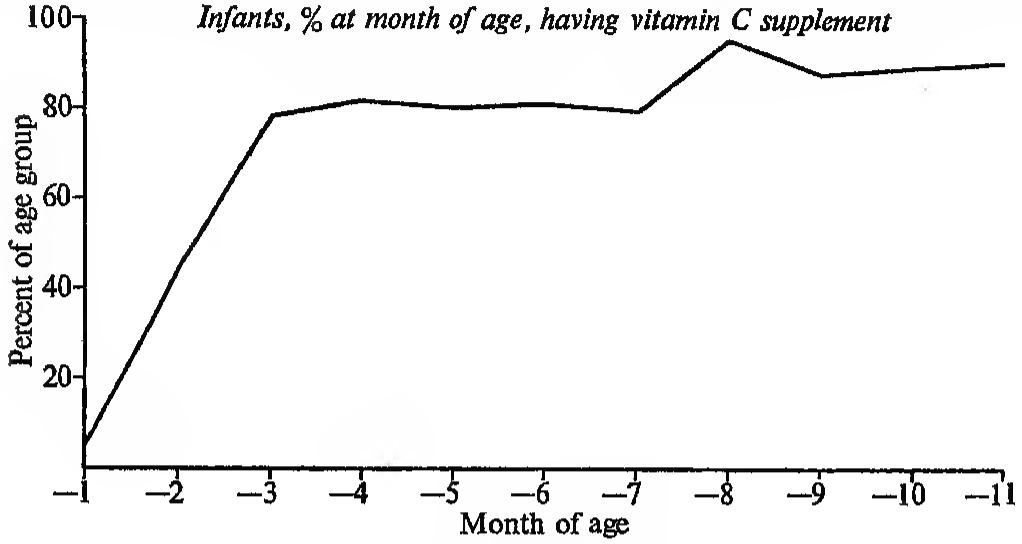

FIGURE 2

5. The following table shows that of the 995 infants receiving vitamin C supplement, 305 (30 per cent.) were being given a fruit juice other than welfare orange juice.

Infants by Age Groups receiving Vitamin C Supplement

No. of children ...	225	426	345	317	1,313
Months of age ...	–2 months	–5 months	–8 months	–11 months	All groups
	Number (per cent.)	Number (per cent.)	Number (per cent.)	Number (per cent.)	Number (per cent.)
Welfare orange juice	53 (24)	231 (54)	183 (53)	154 (49)	621 (47)
Welfare and proprietary	1	9 (2)	24 (7)	35 (11)	69 (5)
Proprietary and fresh orange	Nil	1	3 (1)	5 (2)	9 (1)
Proprietary only ...	11 (5)	89 (21)	64 (18)	61 (19)	225 (17)
Fresh orange only ...	2 (1)	17 (4)	23 (7)	29 (9)	71 (5)
	67 (30)	347 (81)	297 (86)	284 (90)	995 (75)

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Vitamin D Supplement

6. *Cod Liver Oil or Vitamin D Concentrate.* The percentage of infants at each month of age receiving vitamin D supplement in the form of welfare cod liver oil or one of the proprietary brands of oil or concentrate is shown on Fig. 3.

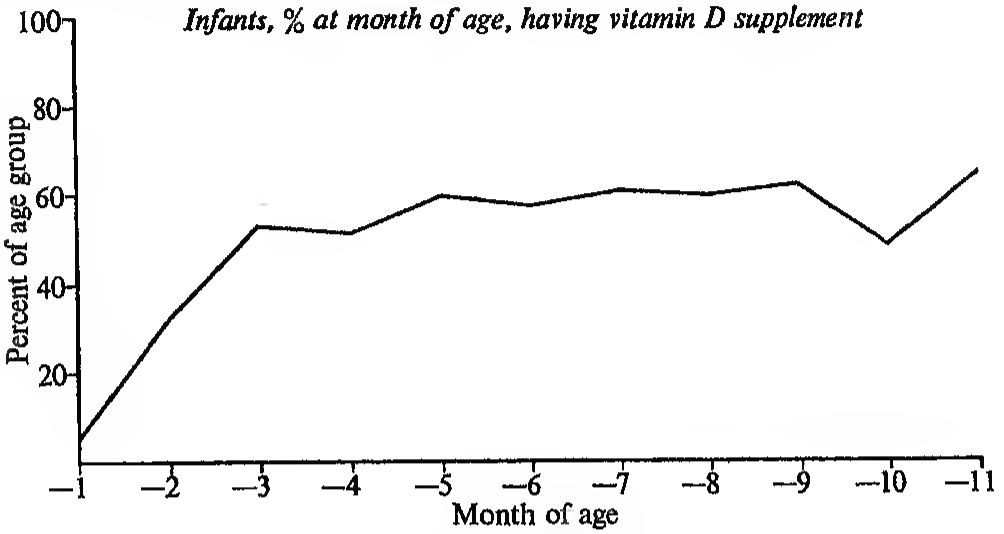

FIGURE 3

7. The following table shows that of the 681 infants receiving vitamin D supplement, 136 (20 per cent.) were receiving a supplement other than welfare cod liver oil.

Infants by Age Groups receiving Vitamin D Supplement

No. of children ...	225	426	345	317	1,313
Months of age ...	–2 months	–5 months	–8 months	–11 months	All groups
	Number (per cent.)	Number (per cent.)	Number (per cent.)	Number (per cent.)	Number (per cent.)
Welfare C.L.O. ...	46 (20)	188 (44)	161 (47)	142 (45)	537 (41)
Welfare C.L.O. + proprietary brand	Nil	3 (1)	2 (1)	3 (1)	8 (1)
Proprietary brands...	6 (3)	46 (11)	43 (12)	41 (13)	136 (10)
	52 (23)	237 (56)	206 (60)	186 (59)	681 (52)

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8. *Fortified Cereal.* Fig. 4 shows the percentage of infants in each age group who were receiving fortified cereal foods.

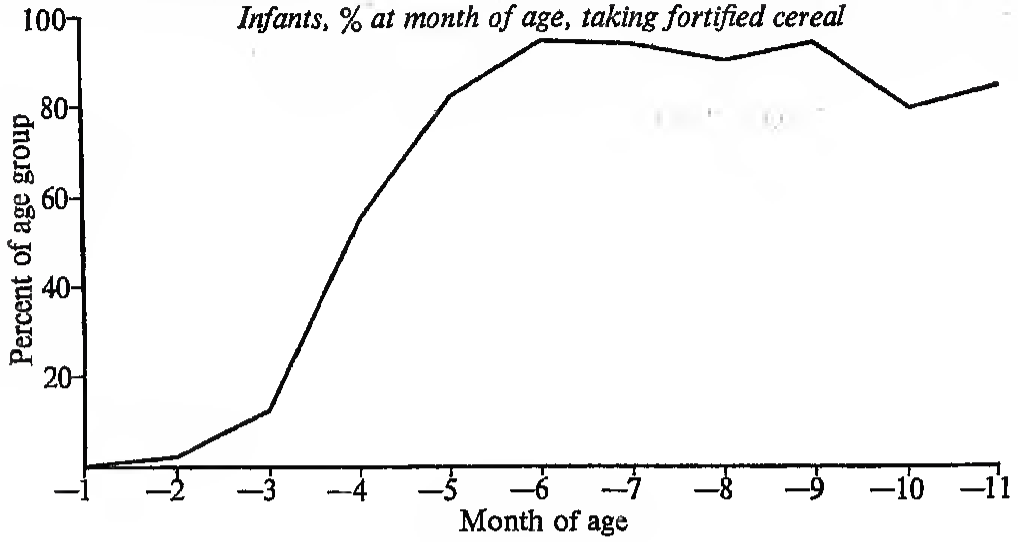

FIGURE 4

Infants at Risk from Hypercalcaemia

9. If it can be assumed that the infants at greatest risk from hypercalcaemia are those who are receiving dried milk + fortified cereal + cod liver oil or concentrate, then the age of maximum risk would appear to be at 5 and 6 months (Fig. 5).

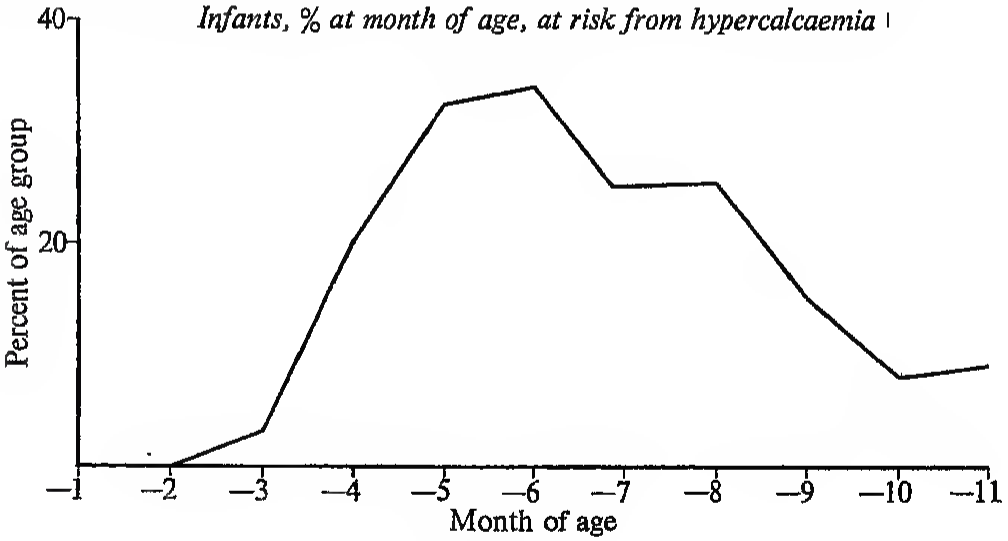

FIGURE 5

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10. Assuming that only those babies fed on cow's milk alone or with an added unfortified cereal food and without a vitamin D supplement are at risk from vitamin D deficiency, then the percentage risk at each month is as follows:

Infants on Cow's Milk and Unfortified Cereal Food

Month of age ...	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10	–11	0–11
No. in group ...	—	4	7	4	—	—	—	2	2	6	4	29
Per cent. of group	—	3	5	3	—	—	—	2	2	5	4	2

If no cereal foods were fortified the percentage of children at risk in each age group would be increased as follows:

Infants at Risk if no Cereal Foods were Fortified

Month of age ...	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10	–11	0–11
No. in group ...	—	5	7	12	13	7	14	13	24	41	24	160
Per cent. of group	—	3	5	8	9	5	13	13	23	37	24	12

The foregoing table is illustrated graphically in Fig. 6.

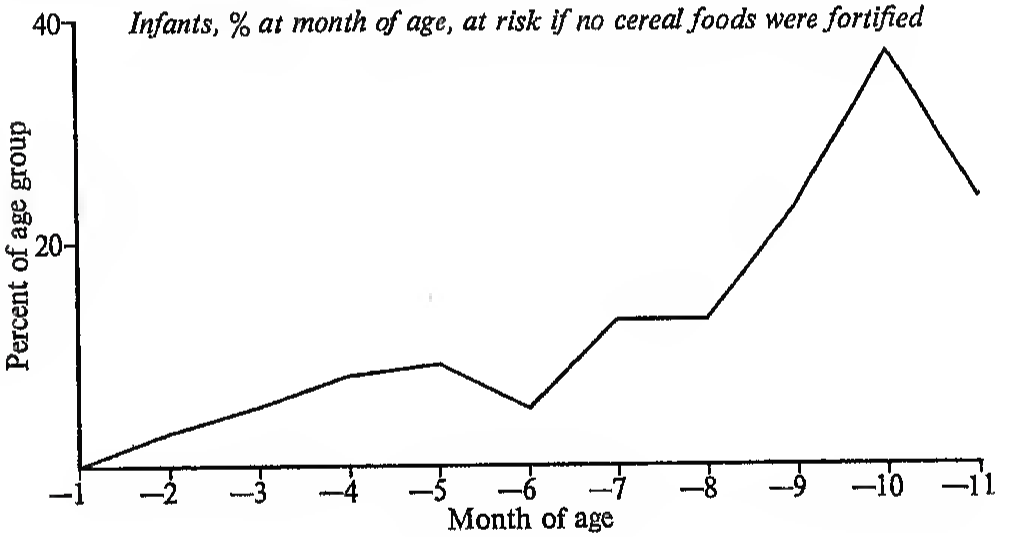

FIGURE 6

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APPENDIX 4

Sources of Vitamin D of Bristol Children aged 6-12 months

1. In November, 1956, the Bristol Public Health Department undertook an investigation into the part played in the diet of children aged 6–11 months inclusive by foods which contain vitamin D, such as infant cereals, dried or evaporated milks, cod liver oil, and other vitamin D preparations. This was done at the request of the Joint Sub-Committee on Welfare Foods, in order to assess the relative importance of infant cereal food as a contributor of vitamin D.

2. Every fifth notification of birth was selected from the register of births over a period which was limited to 5½ months, so that no child should be under 6 months at the beginning, or over 12 months at the end, of the fortnight's survey. Information was obtained by health visitors who asked each mother what form of milk her child consumed, whether in the past 7 days cod liver oil or any other vitamin D preparation had been taken and, if so, how much, and whether the child received any infant cereal. The quantity of cereal was determined on a random group of 232 within the sample.

3. In only 6 per cent. of cases was the child not traced, either because the parents had moved or were temporarily away; the validity of the findings are unlikely to be affected. The composition of the 519 completed records is given in Table 1.

4. Table II shows that very few of the children consumed none of the three sources of vitamin D (dried milk, vitamin preparation, or cereal).

5. Where only one source was consumed this was most commonly cereal, as Table III shows. If cereals were not fortified, the percentage of children receiving vitamin D from none of the sources under consideration would have been 18·6 per cent. instead of only 4·2 per cent., as shown in Table II.

6. Table IV shows the percentages of children who were most likely to consume unnecessarily large amounts of vitamin D, because they took cereal, dried milk and vitamin D preparations.

7. A comparison of Tables VI–VIII shows that of the three sources of vitamin D, cereal was the one most commonly consumed. The contribution made by dried milk may be quantitatively less than might be supposed as many children were stated to be taking liquid milk as well.

8. The mothers of 232 babies were asked how much cereal their children received daily, in terms of teaspoons, tablespoons, or other measures actually used. The weight of cereal delivered by such measures was determined and the results are given in Table IX. It will be seen that the range was considerable. There was little difference in the average amounts consumed by children of different ages. The average intake in ounces of the six age groups, in order, was ·665, ·634, ·704, ·725, ·743, ·680, (in grams, 18·9, 18·0, 20·0, 20·6, 21·1, 19·3). Of the 232 children concerned, 97 took less than ½ oz. of cereal, 116 took ½ to 1½ oz. and the remaining 19 took more than 1½.

9. The members of the sub-committee wish to place on record their gratitude to Dr. R. C. Wofinden, Medical Officer of Health, Bristol, and to his staff, for having undertaken at very short notice the task of obtaining this information.

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TABLE I *Composition of the Sample*

Age	No. of babies
6 months	54
7 ,, ...	89
8 ,, ...	85
9 ,, ...	84
10 ,, ...	110
11 ,, ...	97
All	519

TABLE II *Percentage of Children taking no Source of Vitamin D at all*

Age	Per cent.
6 months	1·9
7 ,, ...	1·1
8 ,, ...	4·7
9 ,, ...	3·6
10 ,, ...	7·3
11 ,, ...	5·2
All	4·2

TABLE III *Percentage of Children taking one Source only of Vitamin D*

Age	Cereal	Dried Milk	Vitamin preparation	Total
6 months	11·1	3·8	1·9	16·7
7 ,, ...	15·7	2·2	1·1	19·1
8 ,, ...	10·6	0	8·2	18·8
9 ,, ...	17·8	2·4	3·6	23·8
10 ,, ...	10·0	3·6	7·3	20·9
11 ,, ...	20·6	4·2	10·3	35·0
All	14·4	2·7	5·8	22·9

TABLE IV *Percentage taking 3 Sources of Vitamin D*

Age	Per cent.
6 months	27·8
7 ,, ...	22·5
8 ,, ...	23·5
9 ,, ...	28·6
10 ,, ...	17·3
11 ,, ...	13·4
All	21·4

TABLE V *Percentage taking 2 Sources of Vitamin D**

Age	Per cent.
6 months	53·8
7 ,, ...	57·3
8 ,, ...	53·0
9 ,, ...	44·2
10 ,, ...	54·5
11 ,, ...	46·4
All	51·4

* In 95 per cent. of these, cereal was one of the two sources.

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TABLE VI *Percentage taking Welfare Cod Liver Oil or Proprietary*

Age	*Per cent.*
6 months	74·1
7 „	69·7
8 „	75·3
9 „	67·8
10 „	69·1
11 „	61·8
All	69·2

TABLE VII *Percentage taking Dried Milk*

Age	*Per cent.*
6 months	42·6
7 „	39·3
8 „	35·3
9 „	42·8
10 „	33·6
11 „	26·8
All	36·0

TABLE VIII *Percentage taking Cereal*

Age	*Per cent.*
6 months	90·7
7 „	92·1
8 „	84·7
9 „	86·9
10 „	79·1
11 „	79·4
All	84·8

TABLE IX *Quantities of Cereal consumed by 232 Children*

Quantities of cereal (in grams)	*Number of children*
0 -	53
10 -	77
20 -	55
30 -	21
40 -	20
50 -	3
60 -	3

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APPENDIX 5

Vitamin D Intakes provided by Various Infant Diets

Average Daily Supply by Fortification in accordance with Sub-Committee's Recommendations

Type of feed	1 Month		2 Months		4 Months		6 Months		9 Months	
	Amount	i.u. Vit. D	Amount	i u. Vit. D	Amount	i.u. Vit. D	Amount	i.u. Vit. D	Amount	i.u. Vit. D
Breast to about 6 months, then liquid cow's milk										
National cod liver oil regularly ...	7–8 drops	50	1 teaspoon	400	1 teaspoon	400	1 teaspoon	400	1 teaspoon	400
Cereal from 4 months (*a*) ...					⅓ oz.	100	⅔ oz.	200	⅔ oz.	200
Total		50		400		500		600		600
Breast to 4 months, then National Dried Milk (*b*)					3·4 oz. dry	320	3·4 oz. dry (*c*)	320	1·9 oz. dry (*c*)	180
National cod liver oil regularly ...	7–8 drops	50	1 teaspoon	400	7–8 drops	50	7–8 drops	50	7–8 drops (*d*)	50 (*d*)
Cereal from 4 months (*a*)					⅓ oz.	100	⅔ oz.	200	⅔ oz.	200
Total		50		400		470		570		430
National Dried Milk from birth ...	1·9 oz. dry	180	2·5 oz. dry	240	3·4 oz. dry	320	3·4 oz. dry (*c*)	320	1·9 oz. dry (*c*)	180
National cod liver oil regularly ...	7–8 drops	50	7–8 drops	50	7–8 drops	50	7–8 drops	50	7–8 drops (*d*)	50 (*d*)
Cereal from 4 months (*a*)					⅓ oz.	100	⅔ oz.	200	⅔ oz.	200
Total		230		290		470		570		430
Mother fails to give cod liver oil										
Cereal sole source of vit. D (*a*) ...					⅓ oz.	100	⅔ oz.	200	⅔ oz.	200
Mother fails to give cod liver oil										
National Dried Milk sole source of vit. D	1·9 oz. dry	180	2·5 oz. dry	240	3·4 oz. dry	320	3·4 oz. dry (*c*)	320	1·9 oz. dry (*c*)	180

(*a*) Amount of cereal taken will increase between 4 and 6 months.
(*b*) The change may be breast to liquid milk, if so the intake from cod liver oil should be 400 i.u.
(*c*) Estimates of National Dried Milk for 6 months on, take into account that present mixed feeding practices result in a lower milk consumption than shown on the feeding table issued with each tin.
(*d*) Intake from cod liver oil should rise to 1 teaspoon, i.e. 400 i.u., as soon as liquid milk replaces National Dried Milk.